Freescale Semiconductor
Technical Data

Document Number: MRF8S9260H
Rev. 0, 12/2009

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF8S9260HR3
MRF8S9260HSR3

Designed for CDMA and multicarrier GSM base station applications with frequencies from 865 to 960 MHz. Can be used in Class AB and Class C for all typical cellular base station modulation formats.

- Typical Single-Carrier W-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 1700 mA, P_{out} = 75 Watts Avg., IQ Magnitude Clipping, Channel Bandwidth = 3.84 MHz, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.

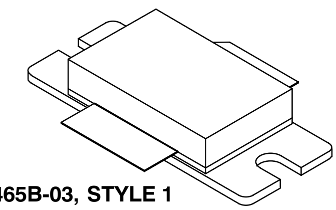
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)
920 MHz	18.8	36.0	6.3	-39.5
940 MHz	18.7	37.0	6.2	-38.6
960 MHz	18.6	38.5	5.9	-37.1

- Capable of Handling 7:1 VSWR, @ 32 Vdc, 940 MHz, 380 Watts CW Output Power (3 dB Input Overdrive from Rated P_{out}), Designed for Enhanced Ruggedness
- Typical P_{out} @ 1 dB Compression Point ≃ 260 Watts CW

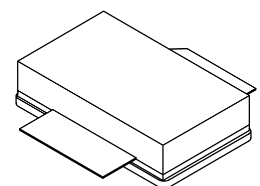
Features

- 100% PAR Tested for Guaranteed Output Power Capability
- Characterized with Series Equivalent Large-Signal Impedance Parameters and Common Source S-Parameters
- Internally Matched for Ease of Use
- Integrated ESD Protection
- Greater Negative Gate- Source Voltage Range for Improved Class C Operation
- Optimized for Doherty Applications
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

920-960 MHz, 75 W AVG., 28 V
SINGLE W-CDMA
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465B-03, STYLE 1
NI-880
MRF8S9260HR3



CASE 465C-02, STYLE 1
NI-880S
MRF8S9260HSR3

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +70	Vdc
Gate-Source Voltage	V_{GS}	-6.0, +10	Vdc
Operating Voltage	V_{DD}	32, +0	Vdc
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature [1,2]	T_J	225	°C
CW Operation @ T_C = 25°C Derate above 25°C	CW	280 1.5	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value [2,3]	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 75 W CW, 28 Vdc, I_{DQ} = 1800 mA Case Temperature 80°C, 265 W CW, 28 Vdc, I_{DQ} = 1100 mA	$R_{\theta JC}$	 0.37 0.31	°C/W

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

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Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1C (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	IV (Minimum)

Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 70 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 400 μAdc)	$V_{GS(th)}$	1.5	2.3	3	Vdc
Gate Quiescent Voltage (V_{DD} = 28 Vdc, I_D = 1700 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	2.4	3.1	3.9	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 4.4 Adc)	$V_{DS(on)}$	0.1	0.2	0.3	Vdc

Functional Tests (1) (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 1700 mA, P_{out} = 75 W Avg., f = 960 MHz, Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset.

Characteristic	Symbol	Min	Typ	Max	Unit
Power Gain	G_{ps}	17.5	18.6	20.0	dB
Drain Efficiency	η_D	36.0	38.5	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	5.5	5.9	—	dB
Adjacent Channel Power Ratio	ACPR	—	-37.1	-35.0	dBc
Input Return Loss	IRL	—	-14	-9	dB

Typical Broadband Performance (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 1700 mA, P_{out} = 75 W Avg., Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset.

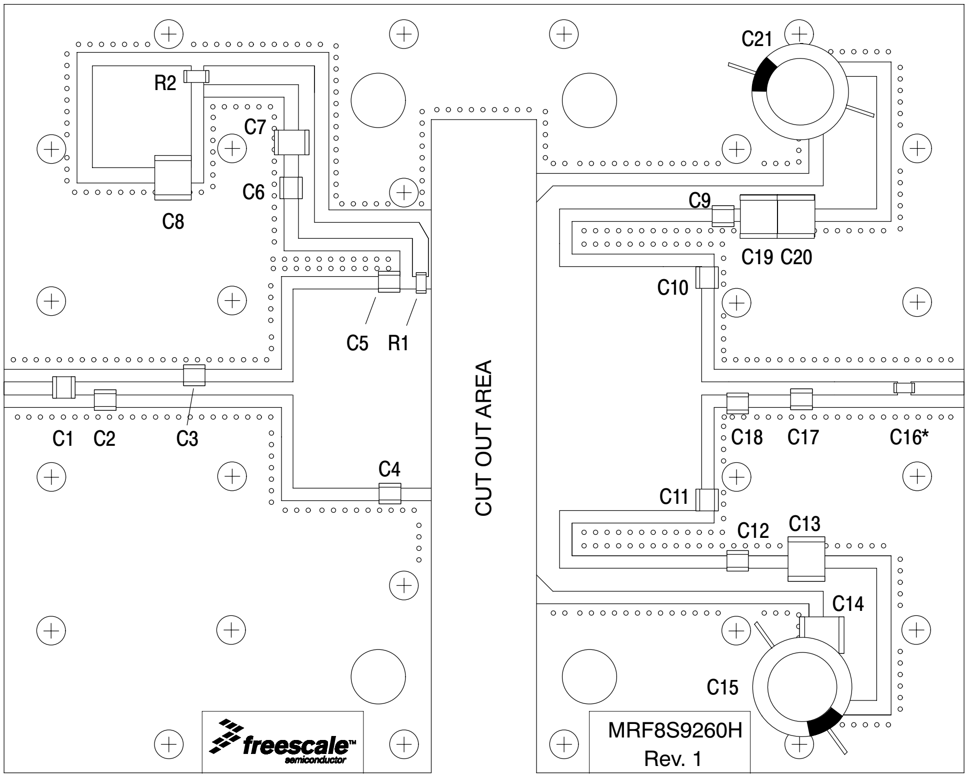
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dB)	IRL (dB)
920 MHz	18.8	36.0	6.3	-39.5	-16
940 MHz	18.7	37.0	6.2	-38.6	-18
960 MHz	18.6	38.5	5.9	-37.1	-14

1. Part internally matched both on input and output.

(continued)

Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performance (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 1700 mA, 920-960 MHz Bandwidth					
P_{out} @ 1 dB Compression Point, CW	P1dB	—	260	—	W
IMD Symmetry @ 130 W PEP, P_{out} where IMD Third Order Intermodulation ≅ 30 dBc (Delta IMD Third Order Intermodulation between Upper and Lower Sidebands > 2 dB)	IMD_{sym}	—	10	—	MHz
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	50	—	MHz
Gain Flatness in 40 MHz Bandwidth @ P_{out} = 75 W Avg.	G_F	—	0.2	—	dB
Gain Variation over Temperature (-30 °C to +85°C)	ΔG	—	0.024	—	dB/°C
Output Power Variation over Temperature (-30 °C to +85°C)	ΔP1dB	—	0.0075	—	dBm/°C



*C16 is mounted vertically.

Figure 1. MRF8S9260HR3(HSR3) Test Circuit Component Layout

Table 5. MRF8S9260HR3(HSR3) Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C6, C9, C12, C16	36 pF Chip Capacitors	ATC100B360JT500XT	ATC
C2	0.4 pF Chip Capacitor	ATC100B0R4BT500XT	ATC
C3	4.7 pF Chip Capacitor	ATC100B4R7BT500XT	ATC
C4, C5	8.2 pF Chip Capacitors	ATC100B8R2BT500XT	ATC
C7	4.7 μF, 50 V Chip Capacitor	C4532X5R1H475MT	TDK
C8, C13, C14, C19, C20	10 μF, 50 V Chip Capacitors	C5750X5R1H106MT	TDK
C10, C11	5.6 pF Chip Capacitors	ATC100B5R6BT500XT	ATC
C15, C21	470 μF, 63 V Electrolytic Capacitors	477KXM063M	Illinois Capacitor
C17	4.3 pF Chip Capacitor	ATC100B4R3BT500XT	ATC
C18	0.8 pF Chip Capacitor	ATC100B0R8BT500XT	ATC
R1	10 Ω, 1/4 W Chip Resistor	CRCW120610R0JKEA	Vishay
R2	0 Ω, 3.5 A Chip Resistor	CRCW12060000Z0EA	Vishay
PCB	0.030″, ε_r = 3.5	RF-35	Taconic

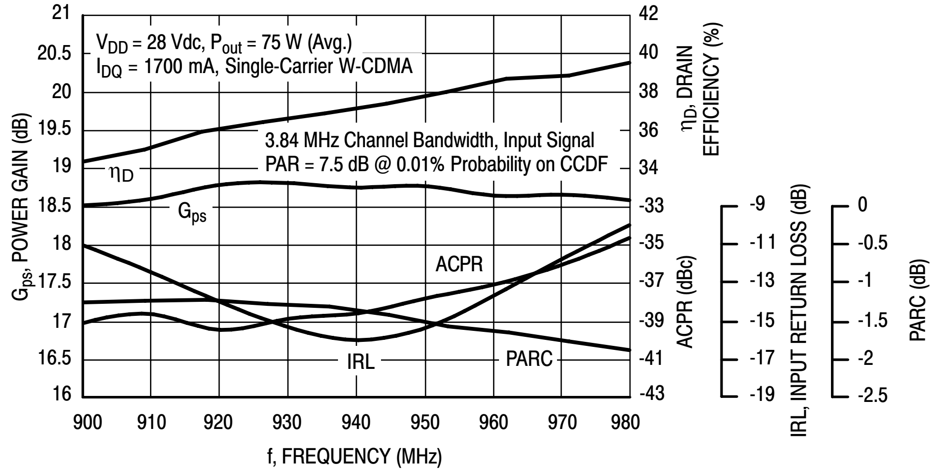


Figure 2. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @ P_{out} = 75 Watts Avg.

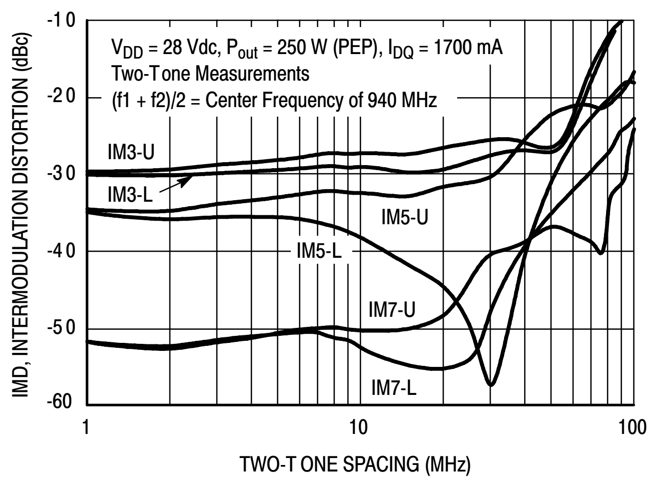


Figure 3. Intermodulation Distortion Products versus Two-Tone Spacing

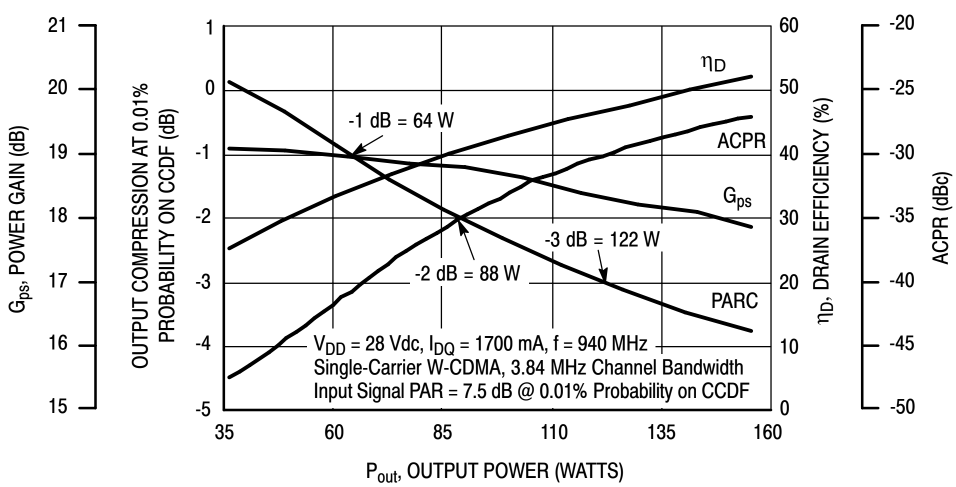


Figure 4. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

TYPICAL CHARACTERISTICS

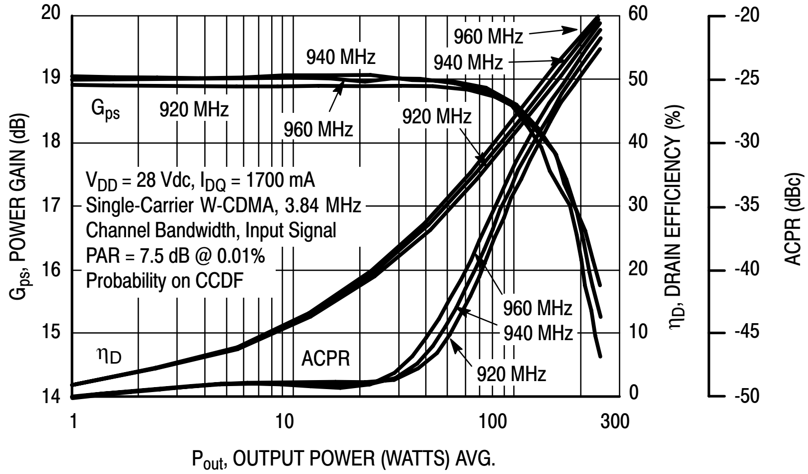


Figure 5. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

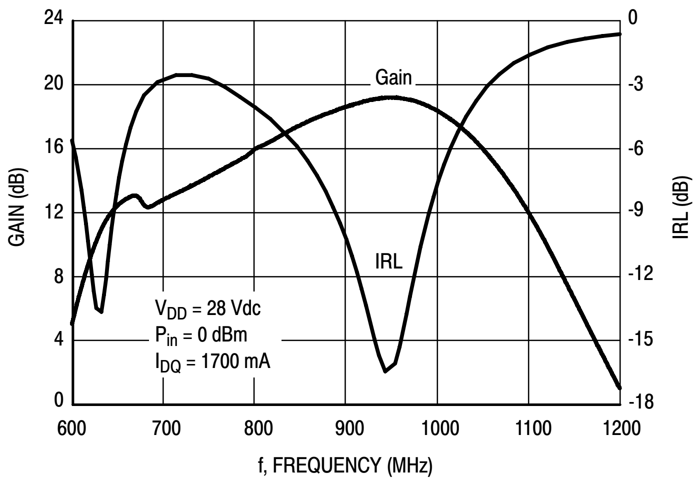


Figure 6. Broadband Frequency Response

W-CDMA TEST SIGNAL

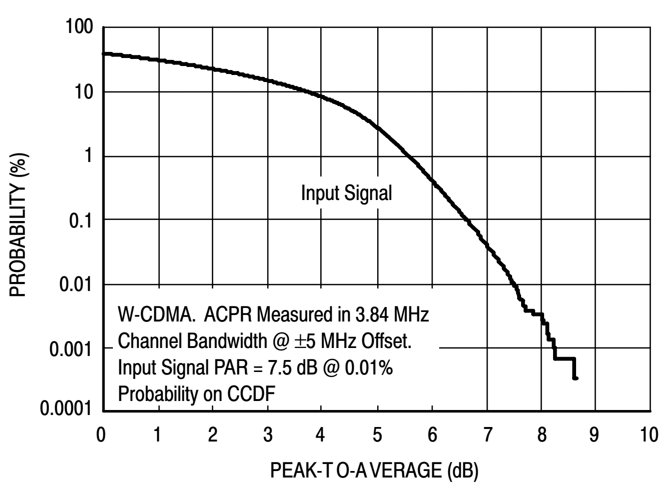


Figure 7. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal

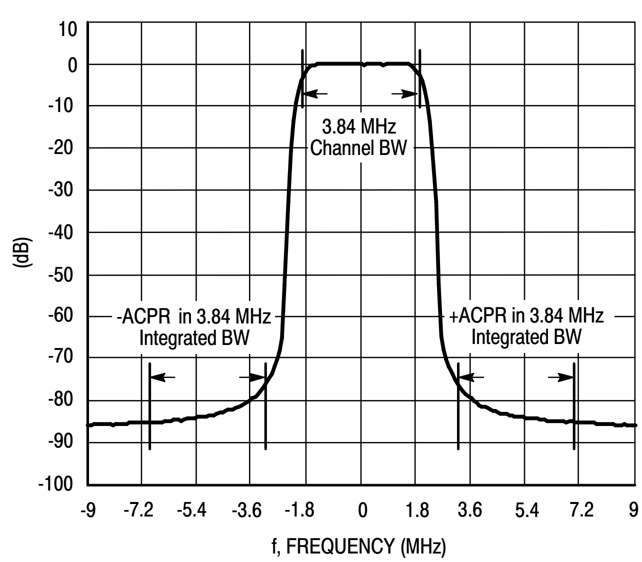


Figure 8. Single-Carrier W-CDMA Spectrum

V_{DD} = 28 Vdc, I_{DQ} = 1700 mA, P_{out} = 75 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
820	2.25 - j2.59	1.93 - j1.63
840	2.21 - j2.51	1.91 - j1.45
860	2.16 - j2.46	1.90 - j1.28
880	2.11 - j2.40	1.90 - j1.14
900	1.98 - j2.37	1.91 - j1.02
920	1.87 - j2.29	1.90 - j0.91
940	1.75 - j2.23	1.89 - j0.83
960	1.61 - j2.14	1.87 - j0.76
980	1.46 - j2.03	1.84 - j0.69

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

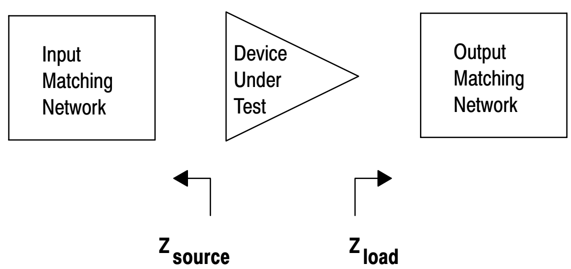
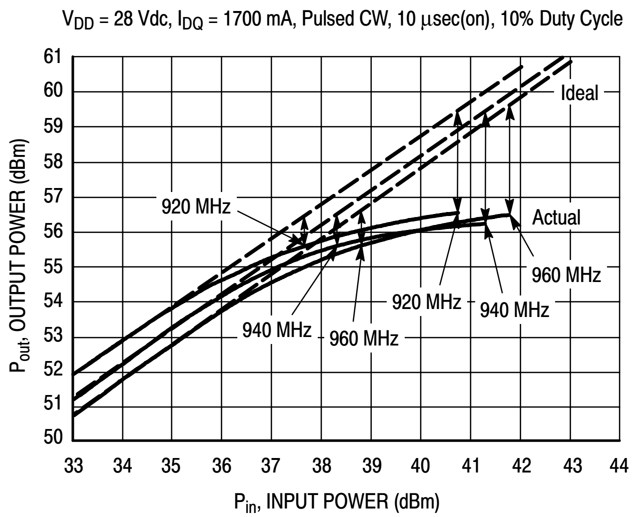


Figure 9. Series Equivalent Source and Load Impedance

ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



NOTE: Load Pull Test Fixture Tuned for Peak P1dB Output Power @ 28 V

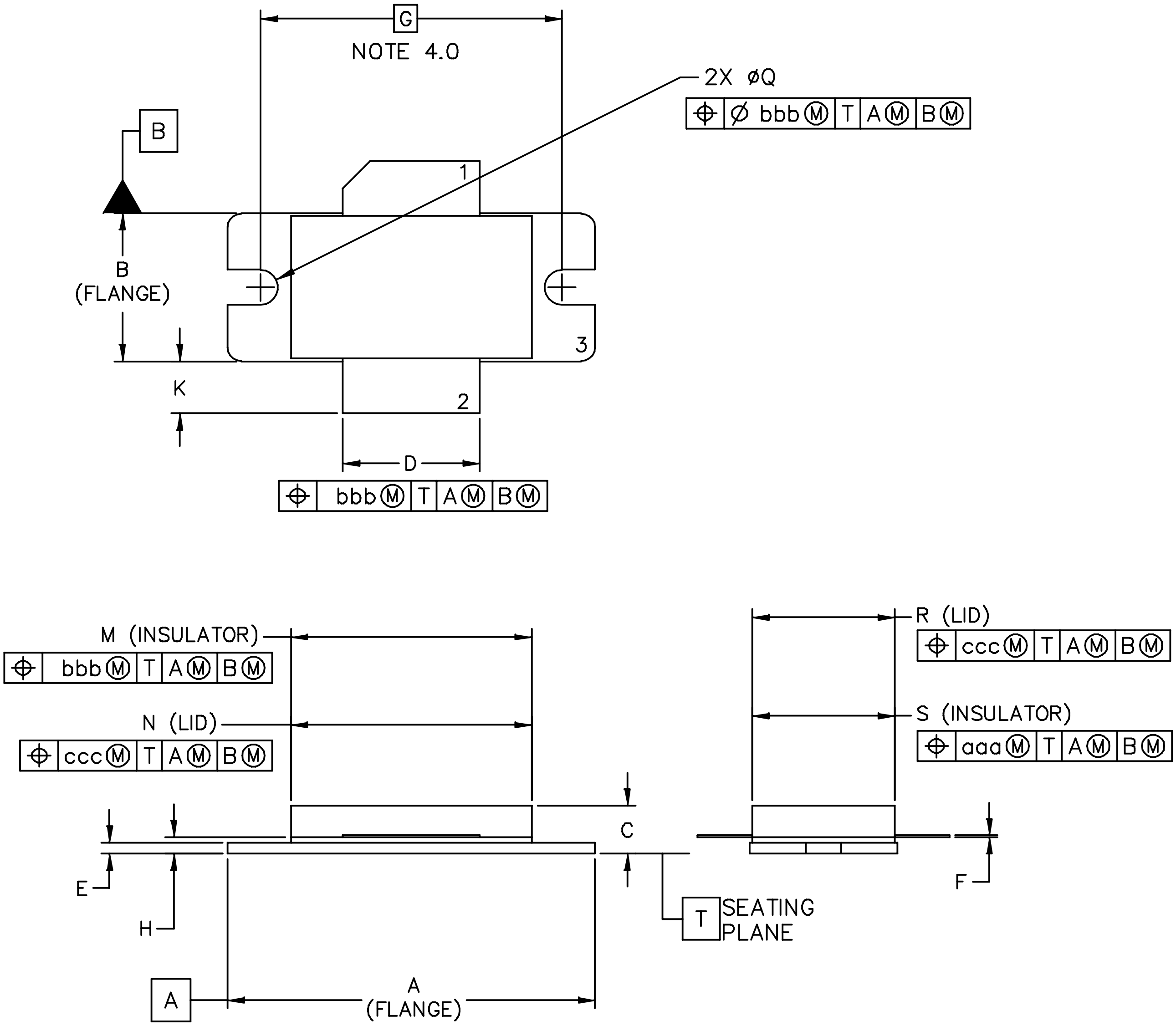
f (MHz)	P1dB		P3dB	
	Watts	dBm	Watts	dBm
920	363	55.6	447	56.5
940	363	55.6	417	56.2
960	363	55.6	437	56.4

Test Impedances per Compression Level

f (MHz)		Z_{source} Ω	Z_{load} Ω
920	P1dB	0.94 - j2.68	2.19 - j2.10
940	P1dB	1.18 - j2.65	2.18 - j2.52
960	P1dB	1.24 - j3.10	2.72 - j2.11

Figure 10. Pulsed CW Output Power versus Input Power @ 28 V

PACKAGE DIMENSIONS



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TITLE: NI–880	DOCUMENT NO: 98ARB18493C	REV: E
	CASE NUMBER: 465B–03	10 SEP 2007
	STANDARD: NON–JEDEC	

NOTES:
1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

2.0 CONTROLLING DIMENSION: INCH.

3.0 DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.

4.0 RECOMMENDED BOLT CENTER DIMENSION OF 1.16 (29.57) BASED ON M3 SCREW.

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

	INCH		MILLIMETER			INCH			MILLIMETER		
DIM	MIN	MAX	MIN	MAX	DIM	MIN		MAX	MIN		MAX
A	1.335	1.345	33.91	34.16	R	.515	—	.525	13.1	—	13.3
B	.535	.545	13.6	13.8	S	.515	—	.525	13.1	—	13.3
C	.147	.200	3.73	5.08	aaa	—	.007	—	—	0.178	—
D	.495	.505	12.57	12.83	bbb	—	.010	—	—	0.254	—
E	.035	.045	0.89	1.14	ccc	—	.015	—	—	0.381	—
F	.003	.006	0.08	0.15	—	—	—	—	—	—	—
G	1.100 BSC		27.94 BSC		—	—	—	—	—	—	—
H	.057	.067	1.45	1.7	—	—	—	—	—	—	—
K	.175	.205	4.44	5.21	—	—	—	—	—	—	—
M	.872	.888	22.15	22.55	—	—	—	—	—	—	—
N	.871	.889	19.3	22.6	—	—	—	—	—	—	—
Q	ø.118	ø.138	ø3	ø3.51	—	—	—	—	—	—	—

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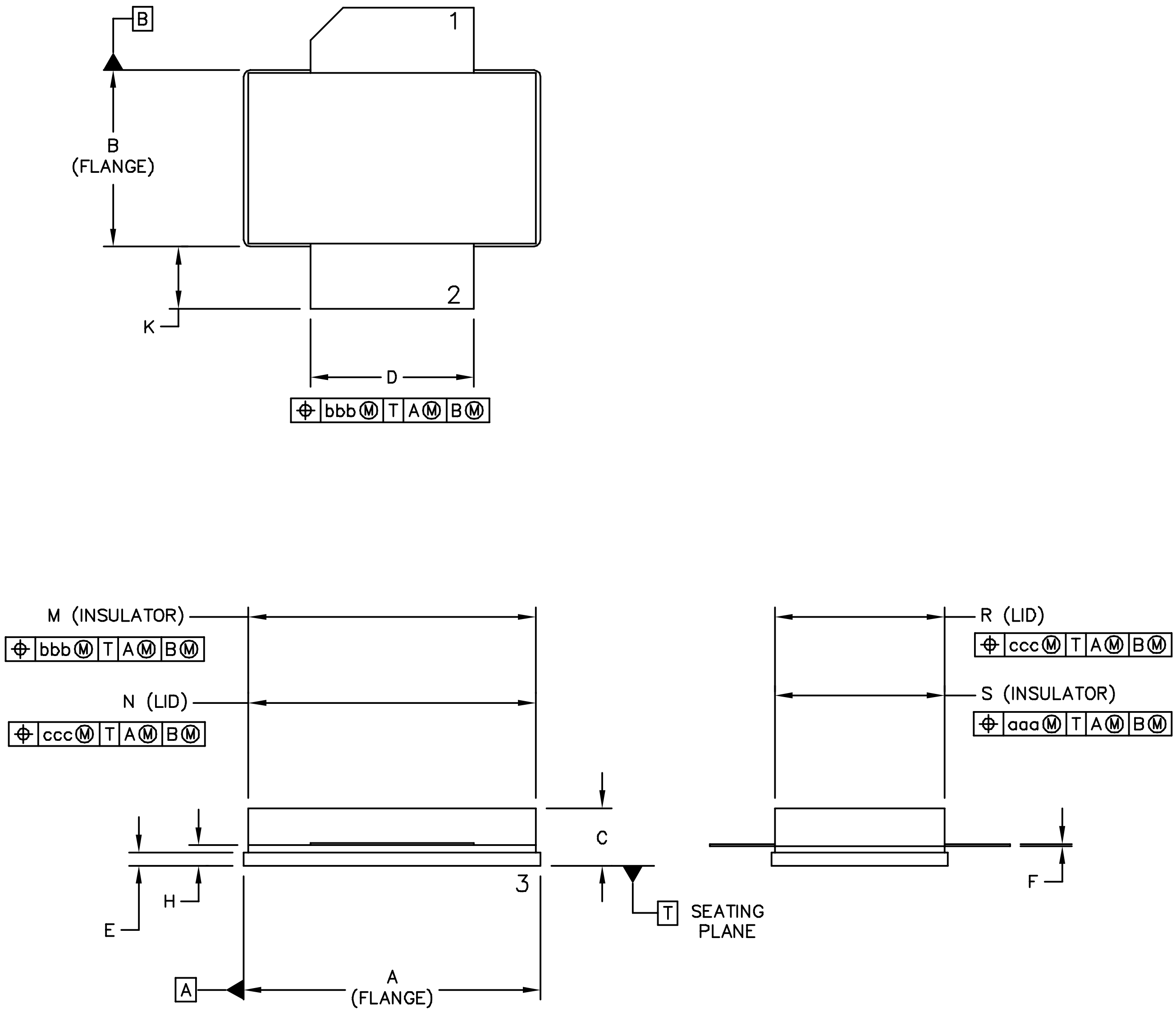

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	CASE NUMBER: 465C–02	09 JUN 2005
	STANDARD: NON–JEDEC	

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.

STYLE 1: PIN 1. DRAIN
2. GATE
3. SOURCE

	INCH			MILLIMETER				INCH			MILLIMETER		
DIM	MIN		MAX	MIN		MAX	DIM	MIN		MAX	MIN		MAX
A	.905	–	.915	22.99	–	23.24	aaa	–	.007	–	–	0.178	–
B	.535	–	.545	13.6	–	13.8	bbb	–	.010	–	–	0.254	–
C	.147	–	.200	3.73	–	5.08	ccc	–	.015	–	–	0.381	–
D	.495	–	.505	12.57	–	12.83	–	–	–	–	–	–	–
E	.035	–	.045	0.89	–	1.14	–	–	–	–	–	–	–
F	.003	–	.006	0.08	–	0.15	–	–	–	–	–	–	–
H	.057		.067	1.45		1.7	–	–	–	–	–	–	–
K	.170	–	.210	4.32	–	5.33	–	–	–	–	–	–	–
M	.872	–	.888	22.15	–	22.55	–	–	–	–	–	–	–
N	.871	–	.889	19.3	–	22.6	–	–	–	–	–	–	–
R	.515	–	.525	13.1	–	13.3	–	–	–	–	–	–	–
S	.515	–	.525	13.1	–	13.3	–	–	–	–	–	–	–

	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
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	CASE NUMBER: 465C–02	09 JUN 2005
	STANDARD: NON–JEDEC	

PRODUCT DOCUMENTATION, TOOLS AND SOFTWARE

Refer to the following documents, tools and software to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

Software

- Electromigration MTTF Calculator
- RF High Power Model
- .s2p File

For Software and Tools, do a Part Number search at http://www.freescale.com, and select the "Part Number" link. Go to the Software & Tools tab on the part's Product Summary page to download the respective tool.

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Dec. 2009	• Initial Release of Data Sheet

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Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor China Ltd.
Exchange Building 23F
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Chaoyang District
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China
+86 10 5879 8000
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